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Coronary Deaths and Organizational Mobility

The 30-Year Experience of 1,160 Men

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THE purpose of this paper is to examine the relationship between intra-organizational mobility and death from coronary heart disease over a period of three decades in an age cohort of 1,160 men drawn from a single industrial organization. A previous paper reported on the methods used and the general findings regarding the 30-year incidence and present prevalence of coronary heart disease within this cohort.¹

During the past half century the proposition that the prominence of social mobility in Western industrial societies has much to do with the widespread occurrence of coronary heart disease within these societies has been put forward repeatedly.²⁻⁸ These societies have approved of and encouraged upward social mobility, while at the same time their changing social structures have increased the opportunities for such mobility. It has been believed that the behavior associated with upward social mobility (which is often referred to as "striving behavior") and the reaction of the mobile person to the new situations that he encounters may have physiological concomitants which increase his risk of developing coronary heart disease.

The studies here reported are focused on social mobility within an industrial organization—that is upon "intra-organizational mobility." By intra-organizational mobility, we mean the movement of a member of an organization from one organizational position to another, be it upward, downward, or lateral. When such moves occur in an industrial organization, they are usually referred to as "promotion," "demotion," and "transfer." Intra-organizational mobility is only one of several kinds of social mobility, but there are good reasons for studying the relation between mobility of this type and coronary heart disease. Mobility within an industrial organization is occupational mobility. Within an industrial society, occupation serves as the best single indicator of social class position.⁹⁻¹¹ Hence, to be mobile in the occupational realm usually means being mobile in one's class position also. Most discussions of the relationship between social mobility and coronary heart disease focus implicitly or explicitly on some aspect of social class mobility. Furthermore, an industrial organization provides a strategic site for the study of social mobility and coronary heart disease, because its structure is rather clearly defined, and one can obtain records of all of the moves that occur within it.¹² An industrial setting therefore permits one to measure accurately some variables and concepts which, under other circumstances,

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have to be dealt with rather imprecisely.

The major purpose of this paper is to consider whether mobility, *by itself*, plays the crucial role in the occurrence of coronary heart disease that some have ascribed to it. Specifically, we are investigating whether the intra-organizational mobility experiences of men who have died of coronary heart disease within an age cohort have been strikingly different from those of other men in the same cohort. If these experiences have been significantly different, we may argue that intra-organizational mobility could account for much of the observed variation in coronary heart disease rates regardless of other social, psychological and physiological factors. If we find no relationship, then we may question whether mobility, *per se*, plays nearly so preeminent a role as some have suggested; and, further, we may hypothesize that if mobility has any effect at all, it can be discerned only within a multifactorial context.

Method

The organization selected for this study is a unit of the Bell Telephone System—a nationwide industrial network with more than 700,000 employees—of whom approximately 260,000 are men employed in the Bell System Operating Companies. The industry is hierarchically arranged into eight strata: a non-management stratum, and seven levels of management. The non-management employees are predominantly skilled workmen and white-collar employees. Aside from foremen, all other managerial employees are white-collar. Only a very small proportion of the occupations in this industry require a high level of physical activity. The industry is relatively homogeneous in terms of the ethnic characteristics of its members. Most employees are of "Old American" or of West European origin.¹³

The men employed in this industry are, with few exceptions career employees. They generally join the organization in their early twenties, and approximately 80% of them stay on until retirement or death. Thus, the attrition rate among them for all causes is relatively small, especially after they have been on the payroll for five years or more.

At the time that these investigations were undertaken it was not possible to obtain an age cohort of men from the industry as a whole. Therefore, a cohort was selected from one unit.

This company is near the median for all companies in the industry in size, rural-urban distribution of its activities, age of employees, and proportion of those on the payroll who are men. Its formal organization, ie, the arrangement of employees into ranks and various occupational categories, closely resembles that of all the other companies in the industry. The company possesses extensive occupational and medical records on all its employees. The detailed characteristics of this company have been described in a previous paper.¹² Despite its apparently desirable attributes, we have made no assumption that either the unit or the age cohort is representative of the nation-wide industry.

The cohort was selected by obtaining a complete payroll of the company for Jan 1, 1935 and designating all men on this list who had been born between Jan 1, 1902 and Dec 31, 1908, and who had been hired between Jan 1, 1923 and Dec 31, 1930. Of the 1,160 men designated, 274 were college graduates recruited with the intention of making them managers, while 886 were not. On Jan 1, 1935, the median age of the men in this cohort was 30 years—an age at which it could be expected that few or none of them would have already experienced a disabling event of coronary heart disease. Thus, from the point of view of having a first event of disabling coronary heart disease, every man in the cohort was considered to be at risk on Jan 1, 1935. The subsequent medical histories of these men, particularly concerning coronary heart disease, have been described in our previous paper.¹

From company occupational records, we were able to abstract data on nine categories of work experience which have a bearing on organizational mobility: highest rank attained, number of promotions, number of job changes, number of different job titles held, number of demotions, number of company departments served in, number of work location changes, number of transfers to other companies in the industry, and "line-staff" managerial experience, if any. In all but one of these nine dimensions, the basic unit of measurement was the number of changes that had occurred. The only exception was in "line-staff" dimension. Here the measure was a "broader" managerial experience (ie, both line and staff), a "narrower" one (ie, either line or staff), or no managerial experience at all.

To determine the possible relationship between organizational mobility and death due to coronary heart disease, the mobility experiences of those who died from this disease before age 60 were compared with the experiences

of otherwise similar men in the cohort who had equivalent lengths of exposure within the company. Because there were only 65 coronary deaths and because of the variations in the length of exposure of various men to the organization before their death, a matching procedure was utilized. First, each man who died of coronary heart disease was matched with a man who died of another cause and whose age at death and year of death was closest to that of the "coronary man." Where several men qualified for the matching procedure, a table of random numbers was used to make the final selection. In addition, "college men" (ie, men with a college degree when hired), were always paired with other "college men," and "no-college men" (ie, men without a college degree when hired) were always paired with other "no-college men." This was done because college graduates are hired by the company with the specific expectation that most of them will become managers: although a considerable number of "no-college men" ultimately do become managers, the proportion of those who do is much smaller than the proportion of "college men." "College men" are more likely to be promoted, are promoted earlier and are more likely to reach higher ranks than are "no-college men."¹³

Each man who died of coronary heart disease also was matched with another man of similar education who was still living and on the payroll on Jan 1, 1965. When the three groups of 65 men each had been designated, the mobility experiences of the men who had died were considered up to the time of their death; and the mobility experiences of the living men were considered up to the time at which their paired companions had died.

The "matched trios" were contrasted in terms of the nine dimensions of organizational mobility discussed above. These dimensions probably reflect the major aspects of such mobility. However, it could not be presumed that these dimensions were independent. On empirical grounds alone an overlap seemed to be inevitable because a promotion ordinarily involves a job change, and occasionally a change in work location also. Furthermore, some sociologists have suggested that certain types of lateral organizational moves are frequently preparatory for upward organizational mobility.¹⁴ To overcome the problem of overlap among our dimensions of movement, we used the technique of principal component analysis.¹⁵ It was hoped that this technique would allow us to discern meaningful patterns among the nine mobility dimensions.

Results

"Mobility" and "Immobility" Factors.—

The principal component analysis identified two factors which account for approximately 60% of the observed variation (Table 1). The major factor, accounting for 45% of the variation, was composed of five highly inter-correlated dimensions: final level attained, number of promotions, number of job changes, number of job titles, a line-staff experience. Each of these dimensions has factor loadings of 0.777 or higher. Since rank and number of promotions played such a prominent role in this factor, we have labelled it the "organizational mobility" factor.

A second factor accounted for about 15% of the observed variation. This factor was primarily composed of four dimensions: number of demotions (with a factor loading of 0.610), number of job changes (with a factor loading of 0.532), number of job location changes (with a factor load of 0.490), and number of job title changes (with a factor loading of 0.390). Although this second factor accounted for a much smaller proportion of the variation, it seemed to be important because it correlated negatively with three of the dimensions that made up the "organizational mobility" factor: final level, number of promotions and line-staff experience. Since this factor was so closely associated with demotions and the absence of upward mobility, it has been termed the "organizational immobility" factor.

Table 1 indicates that three dimensions, ie, title changes, job changes, and job location changes, are positively correlated with

Table 1.—Beta Weights of Principal Component Solution

	"Mobility" Factor 1	"Immobility" Factor 2
Percent of Variance	45.1	14.8
Beta Weight for Factor		
Loadings		
Final Level	0.861	—0.332
Promotions	0.852	—0.324
Line-staff experience	0.862	—0.189
Job title changes	0.855	0.390
Job changes	0.777	0.532
Job locations	0.591	0.490
Demotions	0.128	0.610
Departments	0.429	0.018
Company transfers	0.146	—0.156

Table 2.—Non-parametric Sign Test of Mobility and Immobility Scores*

	Number of Pairs With Higher Score					
	Coro- nary Death	Other Death	Coro- nary Death	Sur- vivor	Other Death	Sur- vivor
Factor 1	34	31	24	41	23	42
"Mobility"	$P = 0.476$		$P = 0.369$		$P = 0.354$	
Factor 2	27	38	28	37	33	32
"Immobility"	$P = 0.415$		$P = 0.431$		$P = 0.492$	

* Comparison of coronary deaths, other deaths, and survivors.

both the "mobility" and "immobility" factors. This does not seem to be as contradictory as it may first appear. Data from the intensive study of the social characteristics and experiences of a sample of 356 men drawn from this cohort indicated that such changes at times serve as substitutes for actual upward mobility.¹³

Mobility, Immobility, and Coronary Deaths.—The existence of the two factors made it possible to consider two alternative working hypotheses: (1) that those who died from coronary heart disease experienced a greater amount of organizational mobility than either the men who died from other causes or the survivors; or (2) that those who died of coronary heart disease experienced a greater amount of organizational "immobility" than either those who died from other causes or the survivors. To ascertain whether either of these hypotheses had any validity, scores on the "mobility" and "immobility" factors were derived for each man in our group of matched trios. A non-parametric sign test was used to compare the scores of men who died of coronary heart disease with the scores of men who had died from other causes and with the scores of those who survived (Table 2).

Neither of our working hypotheses was substantiated. The "mobility" and "immobility" scores of the men who died from coronary heart disease were not significantly different from the scores of those who died from other causes or from the scores of those who survived. To ensure that the technique of principal component analysis had not obscured the effect of any one of the nine dimensions, the three groups were also compared on each dimension singly. In no case was it found that the coronary men had

scores significantly different from the scores of the other dead men or from those of the survivors.

One finding may warrant further attention: the survivors tended to have somewhat higher mobility scores than either of the groups of dead men. This "trace" of a relationship falls between the 0.10 and the 0.05 level of significance when the men who died of coronary heart disease are compared with the survivors. It is significant at the 0.05 level when the men who died of other causes are compared with the survivors. This finding is too weak to treat as anything more than a clue that invites further inquiry. On the other hand, a "common sense" explanation suggests itself: that many men who died before the age of 60 had been chronically ill, and their illness influenced their mobility experiences, and not vice versa.

Comment

Since our cohort is not a probability sample of the nation-wide industry, one cannot draw from it any firm inferences about the entire industry. One can only say that there is no indication that promotions and transfers taken by themselves have had a marked effect on the risk of death from coronary heart disease among men in this group. However, we have no reason to believe that the experiences of these men have been strikingly different from the experiences of the men in the industry as a whole; and the data suggest the hypothesis that intra-organizational mobility, considered without reference to other variables, is not a crucial factor for the larger proportion of coronary deaths that occur in this industrial population. Thus, one might well be advised to direct subsequent research on the relationship of intra-organizational mobility and coronary heart disease toward the study of these two phenomena within a multifactorial framework rather than toward further investigation of these factors in isolation.

Not all social mobility experiences are covered by our study. Intra-organizational mobility is only one of several phenomena that are ordinarily subsumed under the general term "social mobility." Intra-organizational mobility is not the same as inter-

occupational mobility (ie, moving from one employment situation to another), rural-urban mobility, cultural mobility, or inter-generational social class mobility. In the past, all of these latter mobility experiences have been implicated as increasing the risk of coronary heart disease.^{7,16-20} The full significance of the effects of social mobility on the occurrence of coronary heart disease will become clear only after a number of detailed studies of specific types of social mobility have been carried out.

Nor have all facets of intra-organizational mobility been included in the study of this cohort. For example, there are numerically small but possibly significant areas of upward organizational mobility that are very sparsely represented within this cohort. Because of its limited size, there were few highly mobile men within the group. For instance, there were only 21 men among these 1,160 who attained the fifth level of management or a higher one. Also, there are few men within the cohort who experienced inter-company transfers. In the industry under study, intercompany transfers are of special importance because they are linked with past upward mobility and future prospects for further mobility. At the same time inter-company transfers frequently involve geographic mobility; and geographic mobility suggests at least some social and cultural uprooting for an individual and his family. Data on the effect of these and other areas of organizational mobility on the incidence of coronary heart disease must wait the results of the five-year survey of the nationwide industry as a whole, which is now under way.

Furthermore, not all organizational mobility experiences are of the same piece. Clearly, transfers are qualitatively different from promotions. But all promotions do not have the same significance. For example, promotions based primarily upon "quality" tend to carry a meaning different from those based primarily upon "performance."²¹ "Quality" promotions may come as the result of expansion of an organization, or they may be the outcome of long experience and "loyal" service. The amount of "striving behavior" and "occupational stress" associated with such promotions probably is relatively

small. "Performance" promotions, on the other hand, often explicitly presuppose the striving, goal-oriented behavior that may be most relevant to coronary heart disease. "Performance" and "quality" mobility are only analytical types; to what extent a particular promotion partakes of one or the other is an open empirical question. The nature of the data from this cohort does not allow us to consider the effects of these subtle factors on the occurrence of coronary deaths.

All of the preceding suggests that intra-organizational mobility not only has several dimensions but also has numerous correlates. It is possible that the effects of many of these factors on coronary heart disease may be at cross-purposes and that they may actually "mask" the influence of certain mobility experiences. For example, data still under analysis suggest that even when education is held constant, "more mobile" men are less prone to exhibit such potentially important "risk" factors as obesity and heavy smoking. Hence, if the experience of upward mobility is positively linked to coronary heart disease, this relationship may be obscured by other factors that are not experiential. There are data also that suggest that mobility experiences themselves mean different things to "college" and "no-college" men. We have found that these groups do not respond to promotions and the failure to be promoted in exactly the same way. Mobility per se appears to be a more psychologically salient factor for the "college" than for the "no-college" men.¹³ Thus, mobility experiences that are "objectively" the same may have very different psychological and physiological consequences for men of different backgrounds.

One final comment must be made about the generalizability of the findings from this cohort. We have some indications that the intra-organizational mobility experiences of these men are to some extent unique, even for the industry under study. For example, demotions, which ordinarily might be presumed to be deprivational, were in fact not so regarded by many of the men in our cohort. Approximately 13% of the men in this cohort were demoted to lower ranking jobs during the depression of the 1930's. Most of these demotions were designed to "tighten

up" the company structure at a time of economic crisis. They did not represent negative evaluations of those who were demoted; rather, they were intended to save the jobs of men who otherwise might have been laid off. Among the men we interviewed, many said they felt lucky to have been employed throughout the depression, even when this required the acceptance of a lower ranking job. In contrast, the demotion of younger men in the industry today, under circumstances of high organizational prosperity, probably has a quite different psychological significance, and thus, perhaps, a different set of physiological concomitants.

It is evident that until the data from our nation-wide survey are analyzed, no definitive judgment can be made on how applicable the results from this cohort are to the industry in general. Also, the extent to which these findings can be replicated in professional organizations or in selling, advertising, or publishing enterprises must remain a matter of conjecture. These appear to be fruitful sites for future empirical inquiry.

Summary

The relation between intra-organizational mobility and death from coronary heart disease has been studied in an age cohort of 1,160 employees of a regional affiliate of a nation-wide industry. The cohort was designated from the payroll of Jan 1, 1935 when the median age of its members was thirty years. We were able to trace the subsequent status of all but eight of these men. Death certificates of all those who had died during the intervening 30 years were obtained. From company records, data on nine dimensions of intra-organizational mobility were obtained for each man as follows: highest level, number of promotions, number of changes of job assignment, number of job titles held, number of demotions, number of departments to which assigned, number of intra-company location changes, number of

transfers to other companies in the industry, and "line-staff" managerial experience.

Each of the 65 men who died of coronary heart disease was matched with another man of similar age and education who had died of another cause at about the same time, and with a survivor of similar education and age, whose career was studied up to the time at which his paired companions had died. Scores for each man on each dimension were obtained. A principal component analysis was used to correct for overlap among the primary variables and to look for meaningful patterns in the data. Two factors were isolated which accounted for 60% of the variation. The major factor, which accounted for 45% of the variation, was associated with upward mobility. A second factor, which accounted for 15% of the variation, was generally linked with the absence of upward mobility.

The scores of the "coronary deaths," the "other deaths," and the survivors on these two factors were compared by means of a nonparametric sign test. There was no difference in scores between the men who died of coronary heart disease and those who died of other causes for the "mobility" or for the "immobility" factor. However, the scores of the survivors on the mobility factors may have been higher than those of either group who died.

The possible significance and generalizability of these results have been discussed. It has been suggested that in the future research, intra-organizational mobility and coronary heart disease might be studied most fruitfully within a multifactorial context.

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References

1. Hinkle, L.E., et al: Coronary Heart Disease: 30-Year Experience of 1,160 Men, *Arch Environ Health* 13:312-321 (Sept) 1966.
2. Osler, W.: The Lumleian Lectures on Angina Pectoris, *Lancet* 1:696-700, 839-844, 974-977, 1910.
3. Keys, A., and Blackburn, H.: Background of the Patient With Coronary Heart Disease, *Progr Cardiovasc Dis* 6:14, 1963.
4. Dunbar, F.: *Psychosomatic Diagnosis*, New York: Paul B. Hoeber, Inc., 1943.

5. Groover, M.E.: Clinical Evaluation of a Public Program to Prevent Coronary Artery Disease, *Trans Coll Physicians Phila* 24:105, 1957.
6. Rosenman, R.H., and Friedman, M.: Overt Behavior Pattern in Coronary Disease, *JAMA* 173:1320, 1960.
7. Smith, T.: Factors Involving Socio-Cultural Incongruity and Change: A Review of Empirical Findings, read before the National Workshop on Socioenvironmental Stress and Cardiovascular Disease, Phoenix, Ariz, Feb 14-16, 1966, *Milbank Mem Fund Quart* 45(part 2):23 (April) 1967.
8. Russek, H.I.: Stress, Tobacco, and Coronary Disease in North American Professional Groups, *JAMA* 192:189, 1965.
9. Kahl, J.A., and Davis, J.A.: A Comparison of Indices of Socio-Economic Status, *Amer Sociol Rev* 20:317, 1955.
10. Inkeles, A., and Rossi, P.H.: National Comparisons of Occupational Prestige, *Amer J Sociol* 61:329, 1956.
11. Barber, B.: *Social Stratification*, New York: Harcourt, Brace and World, Inc., 1957.
12. Hinkle, L.E.: The Use of a Large Industrial Population to Study the Effects of Social and Behavioral Factors on Coronary Heart Disease, *Amer J Public Health* 56:1470, 1966.
13. Lehman, E.W.: Mobility and Satisfaction in an Industrial Organization, unpublished doctoral dissertation, Columbia University, 1966.
14. Levenson, B.: "Bureaucratic Succession," in Etzioni, A. (ed.): *Complex Organizations*, New York: Holt, Rinehart & Winston, Inc., 1961, pp 362-395.
15. Massy, W.F.: Principal Components Regression in Exploratory Statistical Research, *J Amer Statistical Assoc* 60:234, 1965.
16. Syme, S.L.; Hyman, M.M.; and Enterline, P.E.: Some Social and Cultural Factors Associated With Occurrence of Coronary Heart Disease, *J Chronic Dis* 17:277, 1964.
17. Syme, S.L.; Borhani, N.O.; and Buechley, R.W.: Cultural Mobility and Coronary Heart Disease in an Urban Area, *Amer J Epidem* 82:334, 1966.
18. Stamler, J., et al: Prevalence and Incidence of Coronary Heart Disease in Strata of the Labor Force of a Chicago Industrial Corporation, *J Chronic Dis* 11:405, 1960.
19. Tyrikerm, H.A., and Cassel, J.: Health Consequences of Culture Change: Effect of Urbanization on Coronary Heart Disease Mortality Among Rural Residents, *J Chronic Dis* 17:73, 1964.
20. Bruhn, J.G.: An Epidemiological Study of Myocardial Infarctions in an Italian-American Community: A Preliminary Sociological Study, *J Chronic Dis* 18:353, 1965.
21. Parsons, T.: *The Social System*, Glencoe, Ill: The Free Press, 1951.

ADDED ADDITIVES

A food additive, in the general sense, is ". . . a substance or mixture of substances, other than a basic foodstuff, that is present in food as a result of any aspect of food production, processing, storage, or packaging. The term does not include chance contaminants." . . . A substance may be present in a food only as a consequence of its having been used as an aid to production or storage, as for example a pesticide residue or a substance derived from a packaging material. Such substances have been called incidental additives. Other substances are purposely added to foods to perform some function in processing, formulation, or preservation. These have been called intentional additives.

The chemical or substances included in these classes of additives number many hundreds. A recent compilation lists about 1,700 intentional food additives along, of which over 1,000 are used in flavors. There are over 100 pesticide chemicals in use plus a variety of carriers, diluents, sticking agents, propellants, and other substances used in conjunction with the active ingredients. And there are several hundred chemicals used in formulating food packaging materials which might become additives: the basic glass, film, paper, metal, cloth, or wood, plus the sizings and coating materials; the plasticizers, the adhesives, the dyes and printing inks, and the solvents, germicides, antioxidants, and other miscellaneous chemicals associated with them. Finally there are a few additives that result from use of feed adjuvants and drugs for domestic animals, plant growth regulators, and substances for maintenance and sanitation of food processing equipment.—Johnson, P.E.: Health Aspects of Food Additives, *Amer J Public Health* 56:948 (June) 1966.